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# Design and Fabrication of Hybrid Two-Wheeler

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***Abstract***

*Hybrid-electric vehicle (HEV) combines the benefits of petrol engines and electric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power and reduced emission leads to green environment. In recent days, availability of fuel source is depleting day by day and due to more consumption of fuel, the environmental pollution is increasing. In order to overcome that issue we have remodelled a two wheeler as a hybrid two wheeler which means the vehicle can use electric power additionally for its working. In hybrid two-wheeler, there are three modes such as fuel mode, electric mode and dual mode. Initially, vehicle runs in fuel mode and after saving energy from this using dynamo, electric mode starts and the motor is used to run the vehicle and the speed of the vehicle is controlled by using rheostat; and in dual mode, both engine and motor are used in case of high load carrying and quick travel.*

***Keywords:*** *HEV, dynamo, emission, fuel reduction, load torque and modes of operation*

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## INTRODUCTION

### Motivation for the Project

Today, usage of vehicle has increased erratically so that usage of fuel also increases that leads to increased emission of vehicle, which causes the ozone layer depletion, dwindle in source of fuel. In order to overcome all these troubles, we have designed a vehicle which is able to work in both gasoline and electrical supply. Initially the vehicle is run by using gasoline supply, which drives the internal combustion engine and the dynamo is connected to the vehicle chain drive which is used to convert mechanical energy into electrical energy and the energy is being stored in the battery. After the battery is fully charged, the energy stored in the battery drives the electric motor connected to the back wheel and fuel supply is stopped. Whenever the battery is drained, again the fuel is supplied to the engine and the process is continued. The usage of electric drive reduces the emission and the running cost of the vehicle also decreases.

### Existing Technology

There is no hybrid two-wheeler commercially existing [1]. But they exist separately as fuel powered or electric power vehicle separately. In fuel based two-wheeler, internal combustion engine is used to drive the vehicle, and in electrical based vehicle, electric motor is used to drive the vehicle which gets energy from rechargeable battery. Electric based vehicles have zero emission but have low torque and power compared to fuel based vehicles which produce more power and torque but also more emission. In order to overcome this issue, we go for hybrid two-wheeler which is able to produce good power and torque with low emission.

A research work in this field is that, which uses an ECM board to switch between fuel based system and electrical system, based upon the speed conditions [2–4]. Another technology utilizes the use of a hub motor [5, 6], which can be fitted directly on the hub of the bike. In relation to the above mentioned technology, one such work uses a permanent magnet brushless DC motor, which is also fitted directly to the hub of the vehicle [7].

### Demerits of Prevailing Technology

According to Sankey diagram, for gasoline engines only 25% of fuel energy is converted to useful work and rest is rejected into the atmosphere (Figure 1). Nearly 40% energy is wasted in exhaust and 30% as coolant. Burning of fuel also leads to expulsion of gases which may further lead to increase in global warming.

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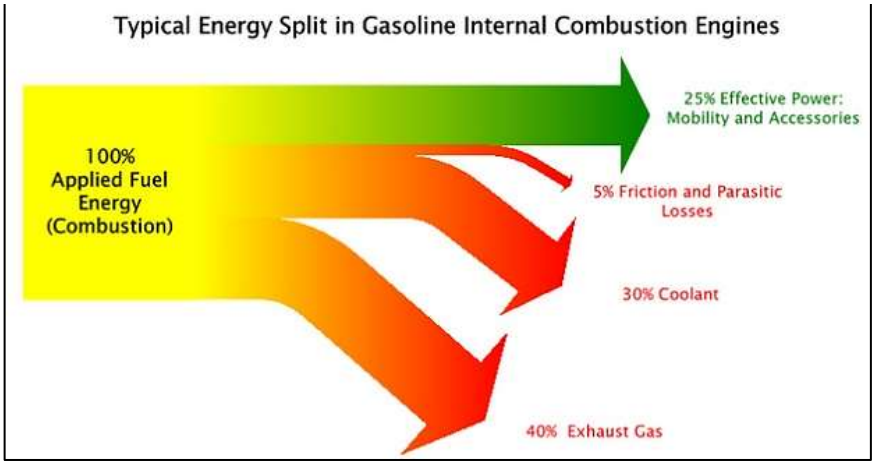


***Fig. 1:*** *Sankey Diagram.*

The hub motor based dual drive system is a good alternative to petro fuel based vehicles, yet it lacks in producing the desired torque from the 570 rpm 750 W motor [5, 7].

## PROBLEM STATEMENT

In India, the rate of fossil is high compared to other countries and also emission of vehicles causes air pollution in the environment. We have to achieve maximum efficiency of the vehicle by using less amount of fuel and low emission without drastic reduction in torque and power.

Hence to achieve maximum efficiency of the vehicle by using less amount of fuel, people prefer to use less amount of fuel consumption and also polluting vehicles to travel in a sophisticated manner.

## PROPOSED SYSTEM

The system is developed for reducing the emission and also to increase the mileage of the vehicle. Initially, vehicle is run by internal combustion engine by using the fuel supply and the dynamo is connected to the engine chain drive which is used to convert mechanical energy into electrical energy and the energy is stored in the battery which is connected to dynamo after the battery is fully charged; the supply to the engine is fully stopped and the electric motor is used to run the vehicle which is connected directly to the back wheel and the energy is supplied to the motor from the battery; after the energy is drained in the battery, again fuel is supplied to the engine which drives again both, the vehicle and dynamo and the process continues. The proposed model is shown in Figure 2.

***Fig. 2:*** *Proposed Model.*

### Components and its Properties

#### *Chain Sprocket*

There is a chain sprocket used in the system (Figure 3). Chain sprocket has straight teeth cut and transmits the power constantly to the other gear. Two gears are of same size and connected to the engine crank shaft and pneumatic cylinder. The gears are made up of stainless steel which has high strength and medium weight. Another one gear is connected to the output shaft from the compressor instead of pulley.

#### *Dynamo*

A dynamo is an electrical generator that produces direct current with the use of a commutator (Figure 4). The electric dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation in to a pulsing direct electric current through Faraday's law of

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induction. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. The motion of the wire within the magnetic field causes the field to push on the electrons in the metal, creating an electric current in the wire.

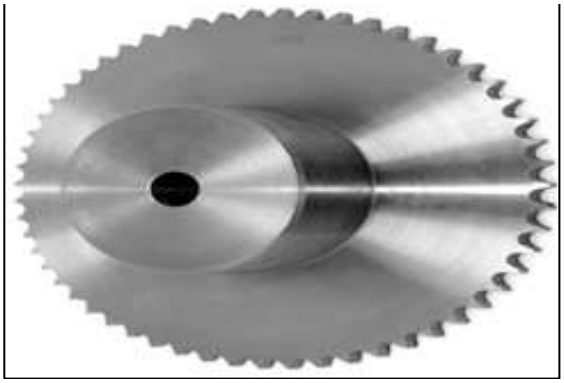

***Fig. 3:*** *Chain sprocket*

***Fig. 4:*** *Dynamo*

***Fig. 5:*** *12V Battery*

***Battery***

An automotive battery, as shown in Figure 5 is a type of rechargeable battery that supplies electric energy to an automobile. An automotive SLI battery (starting, lighting and ignition) is an automotive battery that powers the starter motor, the lights, and the ignition system of a vehicle's engine, mainly in combustion vehicles. Automotive SLI batteries are usually lead-acid type, and are made of six galvanic cells connected in series to provide a nominally 12 V system. Each cell provides 2.1 V for a total of 12.6 V at full charge. Heavy vehicles, such as highway trucks or tractors, often equipped with diesel engines, may have two batteries in series for a 24 V system or may have series-parallel groups of batteries supplying 24 V.

***Electric Motor***

An electric motor is an electrical machine that converts electrical energy into mechanical energy (Figure 6). Electric motors are used to produce linear or rotary force (torque). The reverse of this would be the conversion of mechanical energy into electrical energy and is done by an electric generator. In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In an electric motor, the moving part is the rotor, which turns the shaft to deliver the mechanical power. The rotor usually has conductors laid in to it which carry currents that interact with the magnetic field of the stator to generate the forces that turn the shaft. However, some rotors carry permanent magnets, and the stator holds the conductors.

**Working**

Two-wheeler works initially by fuel as source of energy which runs the internal combustion engine and the engine drives the vehicle and also the dynamo which is used to convert mechanical energy into electrical energy and the dynamo is attached to chain drive which connects the engine and rear wheel. The dynamo connects to the battery which is used to store the energy and the energy is supplied to the electric motor which is connected to the chain drive.

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***Fig. 6:*** *DC Electric Motor*

When engine is working, the energy is stored in the battery by means of dynamo; after the battery is fully charged, the fuel supply to the engine is stopped and then electric motor drives the vehicle and the speed of the vehicle is controlled by means of rheostat. After the battery is drained, again fuel is supplied to the engine and the engine runs the vehicle and the process continues. My project works in both, the series and parallel mode because energy is stored in battery by means of dynamo which is driven by engine and the supply is given to the motor which drives the vehicle and it is called series system hybrid. When the battery is fully charged, both the motor and engine drive the vehicle simultaneously during hill climbing and also during heavy load carrying and it is called parallel system hybrid. The work flow is shown in Figure 7.

***Fig. 7:*** *Working Prototype*

**Designed Model**

The proposed model was designed and simulated using the following software before building its prototype.

***Solid Works (Mechanical CAD Software)***

Solid Works software offers flexible 3D mechanical design and product simulation. It also offers a high-end real time rendering and animation. This contains in-built analysis. The Solid Works model of the proposed model is shown in the Figure 8.

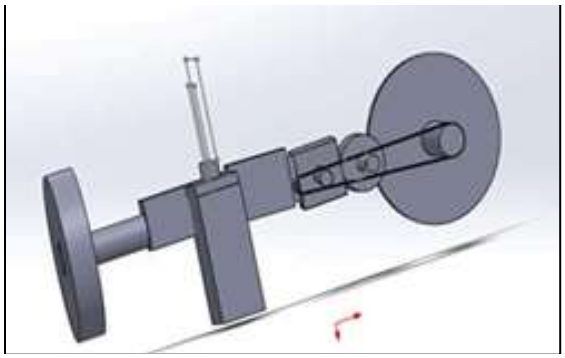

***Fig. 8:*** *SolidWorks 3D Design*

**Working Modes**

***Fuel Mode***

It should work initially at least until the battery is being fully charged and it is used in highway driving and also initially engine is working during this process.

***Battery Mode***

Battery is used as source of fuel and electric motor drives the vehicle and it is used in city driving. In electric mode, the fuel supply is stopped.

***Dual or Hybrid Mode***

In this mode, both the engine and motor work simultaneously but the battery should be charged before this mode and it is used in hill climbing and also in heavy load carrying.

## FEASIBILITY STUDY

The feasibility study is the study of factors influencing the success of the product, for the purpose of resource determination. Providing the solution for the project is more possible in an economic way. The components used in this project are easily available and cheap which makes it economically feasible. As it involves only cheap components it costs around Rs.10, 000. Hence the proposed system proves it to be economically feasible. The system is also operationally feasible. The system uses simple components which are readily available in the market. And also it is easy to work with them. Hence the system also finds to be technically feasible.

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## MERITS AND DEMERITS IN IMPLEMENTING THE VEHICLE AUTOMATION TECHNOLOGY

### Merits

- Lower emission and better mileage.
- Reduction of dependency of fossil fuels.
- Cheaper routine maintenance.
- Combining the best points of the electrical energy and IC engine for vehicle propulsion.

### Demerits

- This system involves an additional battery which may be cumbersome to equip in the vehicle.
- Though this system offers an alternative to petroleum vehicles, it cannot offer the equivalent torque as that to a fuel engine.

## CONCLUSION

Our present generation meets many problems related to global warming as there is a wide increase in the usage of private transport in comparison with the public transport system. Hence by implementing these kinds of systems, the fuel is saved and also there is reduction in usage of fuel from previous amount to lowest amount and the emission is being reduced from 71% of nitrogen to lowest percentage and 14% of carbon dioxide to some lowest percentage and 12% of water vapour to some lowest amount so that there is reduced emission of global warming gas. It strikes a right balance between fuel consumption and pollution control and can be optimized effectively in future generation vehicle. A hybrid motorcycle is capable of mounting a hybrid type drive unit, which does not project in the vehicle in sidewise direction and can be mounted even under the seat near the rear mud-guard.

## FUTURE SCOPE

The implementation of hybrid system in vehicles can be made further advanced by the following ways:

Usage of fuel is reduced so that availability of fuel in the earth remains saved for present calculation of 90 years to more than 90 years. Emission is being reduced so that there is reduction in global warming of gas.

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